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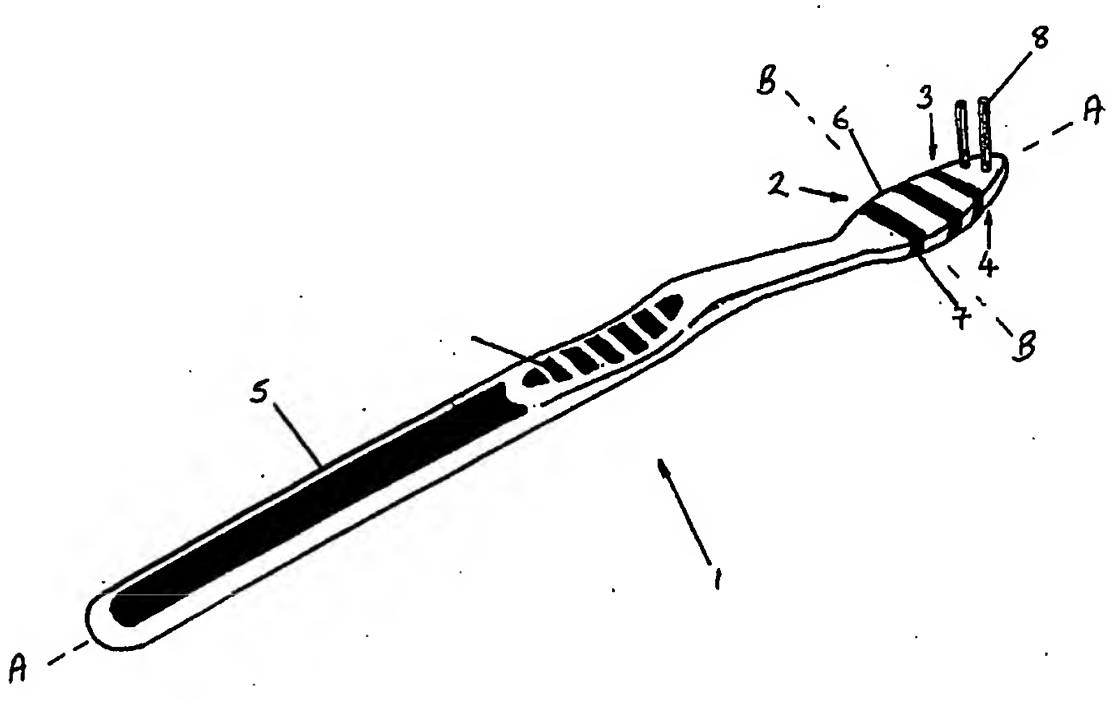

(57) Abstract

The invention relates to a personal grooming implement, such as a toothbrush (1), comprising a segmented head (2), wherein the segments (6) are essentially connected to each other only by an elastomer (7), the elastomer preferably being fused to the adjacent segments. In a preferred embodiment the implement is a toothbrush having segments (6) disposed longitudinally along the brush head (2), the segments being connected to each other only by an elastomer which is fused to each segment. The strength of adherence of the elastomer to the segments is such that the head can be repeatedly flexed in each direction without loss of structural integrity. In this manner the use of hinges to connect the segments can be avoided, thus improving the reliability and ease of manufacture of the brush and providing greater flexibility in head design.

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A GROOMING IMPLEMENT

Field of the Invention

The present invention relates to a personal grooming implement, such as a toothbrush, more particularly to a personal grooming implement having a two component head wherein the head comprises two or more segments, at least one of which is connected to an adjacent segment essentially only by an elastomer which is fused to the adjacent head segments.

Background of the Invention

The configuration of human teeth requires that the ideal bristle contour for toothbrushes for brushing the buccal or outside surfaces of teeth be concave and that the ideal bristle contour for brushing the lingual or inside surfaces of teeth be convex. Most brushes have a single piece head which is of comparable thickness to the handle and which is relatively rigid and of a fixed curvature or configuration.

A further drawback of conventional brushes is that pressing the brush sufficiently hard against the teeth to get good cleaning risks damaging or discomforting the softer, adjacent gums. To a certain extent this can be solved by modifying the configuration of the brush, or by varying bristle hardness or length, though again, a single configuration cannot be optimum for all circumstances.

WO 92/17092, WO 92/17093 and WO 96/02165 disclose toothbrushes having resiliently flexible, bristle-bearing heads, the heads, in certain embodiments being in the form of two or more segments which are flexibly and resiliently linked to each. Gaps between the segments can be wholly or partially filled with an elastomer. In brushes of this type of construction the bond between the elastomer and the body can be subject to great stress, repeatedly applied through frequent use. In most of the embodiments, the segments are linked to each other by hinges or spines of the same material as the brush body. In practice, such hinges or spines can cause difficulties in conventional injection moulding operations since the hinge or spine is subject to fracturing. Further, the presence of non-elastic links in flexible joints can lead to permanent deformation of the joint through repeated flexing, as a result of plastic flow within the non-elastic link. WO 92/17092 discloses some embodiments in which the gap between adjacent head segments is closed by a diaphragm of an elastomeric material. It is not clear in any of these embodiments, however, how the

closure is made or whether it is intended that the diaphragm will substantially contribute to the structural integrity of the brush head.

It has now been found that a sufficiently strong bond can be made between elastomer and the material of the brush body that even a flexible head, which is subject to many cycles of repeat flexure throughout its use, can be constructed that relies principally on the elastomer for holding the head segments together.

It is accordingly an object of this invention to provide a segmented head for a personal grooming implement, such as a toothbrush, which relies principally on the elastomer for holding the head segments together.

It is a further object of this invention to provide a segmented head for a personal grooming implement which can flex resiliently and which has good long-term durability.

It is yet a further object of this invention to provide a segmented head for a personal grooming implement which is suitable for short cycle time injection moulding.

Summary of the Invention

According to the present invention there is provided a personal grooming implement, the implement comprising: a handle having two ends, and at one end of the handle a head comprising two or more segments, at least one of the segments comprising a grooming means, the segments being made from material having a modulus of elasticity of at least 500 MPa, the head being characterised in that at least one of the segments is joined to an adjacent segment or to the handle by a connecting means consisting essentially of an elastomer having a modulus of elasticity of less than 500 MPa, the elastomer being connected to the adjacent segments and/or to the handle so that the elastomer can be stretched to about 120% of its unstressed length without separation of the elastomer from the head segments.

Detailed Description of the Invention

The personal grooming implement of this invention can be any implement of the type that has a sufficiently elongated handle for the user to grip and, disposed at one end of the handle, a segmented head comprising a grooming means. The implement can, for example be a toothbrush, hairbrush or a massaging implement. More especially, it is a toothbrush.

At least one of the head segments comprises a grooming means. Preferably, each segment comprises a grooming means. The grooming means can take the form of

bristles, combing teeth, polishing materials, rubber massage pads and the like. In preferred embodiments herein the implement is a toothbrush wherein the grooming means comprises a plurality of bristles extending from the segments of the head.

The head can be detachably connected to the handle, for example to permit replacement of the head when bristles become worn, in which case the head has a point of attachment for the handle. Alternatively, a first head segment can be continuos with the handle. In a preferred embodiment the handle and first head segment is a single piece formed by injection moulding. Preferably the handle and all of the head segments are formed within a single mould by injection moulding. In any case the handle has a longitudinal axis extending between its two ends. This axis also defines the longitudinal axis of the head which is co-extensive with the axis of the handle. Preferably the head is of generally flattened construction having a pair of opposing faces and the head also has a transverse axis lying orthogonal to the longitudinal axis and generally parallel to the opposed faces. References to transverse or longitudinal herein refer to directions which are respectively parallel to these transverse and longitudinal axes, unless indicated otherwise.

The head and handle are generally made of relatively non-compressible materials, preferably with a modulus of elasticity of at least about 500 MPa, more preferably at least about 1000 MPa, which are conventional in the manufacture of toothbrushes, especially plastics materials. Suitable plastics materials include, for example, polyamides and polypropylenes. Polypropylene is preferred. Suitable polypropylenes include the material 'Polypropylene PM 1600' (marketed by Shell), having a modulus of elasticity (ISO 178) of 1500 MPa and Apryl 3400 MA1 from Elf Atochem. Preferably, a foaming agent such as Hydrocerol HP20DP from Boehringer-Mannheim is mixed with the polypropylene at a level of from about 1% to about 3%, preferably from about 1.5% to about 2.5%, by weight of the polypropylene. The foaming agent assists the flow of the polypropylene during moulding. The handle itself is generally rigid and may be of a shape which is conventional in the manufacture of toothbrushes. Optionally, the handle may comprise a neck portion which is more flexible than the rest of the handle.

The head comprises two or more segments, one of which may be coextensive with the handle. Preferably there are two, three or four segments, more preferably four. Many more than this increases the manufacturing complexity and, in a toothbrush where bristle tufts are inserted only into the head segments, makes it difficult to achieve a sufficiently high tuft density on the brush head. The head segments can

have any suitable spatial relationship to each other such as being in layers or arranged, for example, in quadrants of the brush head. Preferably, the segments are disposed in longitudinal sequence along the head so that a longitudinal line drawn from the handle end of the head to the free end of the head passes through the first head segment then the second head segment and so on. More especially, there is a first head segment which is connected to or continuous with the handle and one or more additional head segments arranged in longitudinal sequence towards the free end of the head. Preferably also, the segments are a monolayer so that any line drawn through the head perpendicular to its two opposed faces will generally pass through only one sort of material. In general, each head segment will be made of the same material which will preferably be the same material as the handle so that they can all be made in a single injection moulding step.

In the finished implement, all the head segments are connected by a connecting means. The connecting means can take any form which is suitable for the implement in its intended function. The connecting means can, for example, be adhesive, plastic links which are integral with or detachably connected to the head segments, or metal links. It is an essential feature of the invention, however, that at least one of the segments is joined to an adjacent segment or to the handle by a connecting means consisting essentially of an elastomer having a modulus of elasticity of less than 500 MPa, the elastomer being connected to the adjacent segments and/or to the handle so that the elastomer can be stretched to about 120% of its unstressed length without separation of the elastomer from the head segments.

By "consisting essentially of an elastomer" herein is meant that the elastomer is the sole mechanical link between the one segment and the adjacent segment or handle. By sole mechanical link, what is meant is that there are no continuous, non-elastomeric links such as bridges or springs connecting the segments. The elastomer may, however, have other materials dispersed within it, such as flecks of metal or pigments which might be used, for example, to provide a distinctive appearance or modify the properties of the elastomer. These additional materials will generally make a negligible contribution to the mechanical connection between the segments and/or handle such that their removal would not materially alter the strength of connection. Connecting means between other segments can comprise an elastomer in addition to other mechanical connections such as plastic links, provided that at least one connecting means consists essentially of, or even only of an elastomer. There can be from one to several connecting means which consist essentially of an

elastomer. Preferably, in a multi-segmented head, the connecting means between each adjacent pair of segments consists essentially of an elastomer. In highly preferred embodiments herein the head has a top face and a bottom face and the connecting means extend transversely across the head and from the top face to the bottom face. For example, in a head comprising four segments, longitudinally sequenced along the head, with the first segment being co-extensive with the handle, there are three such connecting means. The bands of elastomer can vary in thickness, either from one band to the next or even across the width or along the depth of the band. Suitably, their thickness, measured along the longitudinal axis, is in the range from about 0.1 mm to about 10 mm, preferably from about 0.3 mm to about 5 mm, more preferably from about 0.5 mm to about 3 mm.

The bands of elastomer can be linear or non-linear. Preferably they are non-linear and take the form of chevrons or waves whose apex points towards the free end of the head.

The elastomer can be connected to the head segments and/or handle by any suitable means, such as by adhesive or by thermal fusion. The elastomer is preferably incorporated into the implement of the present invention by injection moulding, such that the elastomer becomes fused to the head segments and/or handle. It has surprisingly been found that strongest fusion of the elastomer to the segments and/or handle is obtained when a relatively high injection temperature is employed. Preferably the elastomer is injected at a temperature in the range from about 245°C to about 270°C, more preferably in the range from about 250°C to about 260°C. The injection temperature is the temperature at which the elastomer enters the mould. In a typical injection moulding setup involving a screw-feed injection cylinder this may not be the same as the temperature of the elastomer in the cylinder. Preferably a lower temperature is employed in the cylinder, of around 210°C to about 220°C, to reduce the possibility of burning or thermal degradation of the elastomer, heating to the final injection temperature being provided via a hot runner between the cylinder nozzle and the final injection point.

Other preferred conditions for the elastomer injection step include:

a) An injection pressure in the range of from about 30 to about 80 MPa, preferably from about 40 to about 70 MPa, more preferably from about 50 to about 60 MPa and an elastomer injection time of less than one second, preferably less than about 0.8s. Short injection times facilitate the elastomer reaching all the flexible joint areas at the desired temperature.

b) A holding pressure, after the elastomer has been fully injected, in the range of from about 5 to about 15 MPa, preferably from about 8 to about 12 MPa, held for between about 2 to about 5 seconds.

Elastomers are well known in the art of injection moulding. The term "elastomer" herein refers to a material which is both elastically compressible and elastically extensible. For the purposes of this invention, suitable elastomers have a modulus of elasticity of less than 500 MPa. Preferred elastomers for use herein have a modulus of elasticity of less than about 300 MPa, especially preferred are thermoplastic elastomers with a hardness of about 30 Shore A to 74 Shore D, polyolefin types such as styrene-ethylene-butylene-styrene (SEBS) are preferred, for example those based on Kraton® G, but other classes of elastomer, such as polyurethanes and polyamides, can also be used. An exemplary elastomer is 'PTS Thermoflex 75' (marketed by Plastic Technologie Service, Germany), having a modulus of elasticity (ISO 178) of 100 MPa and a hardness (ISO 868) of 80 Shore A. Elastomers PL12291, PL12292, and PL12293 (marketed by Multibase, Saint Laurent Du Pont, France) are also suitable for use herein. In general, choosing the elastomer so that is based upon the same chemical class of polymers as material of the head segments assists in fusing the elastomer to the head segments. For example, when the head segments are made from polypropylene, the elastomer is preferably based upon a polyolefin. The elastomers can optionally be mixed with a suitable plasticiser or foaming agent to make them more compressible. The colour of the elastomer material can be the same as that of the head segments, or it may be different thereby achieving a distinctive striped or otherwise patterned appearance. More than one type of elastomer can be used within the implement as a whole. This may be appropriate, for example when it is desired to modify the head flexibility progressively along its lengths. One way of achieving this is to use a soft elastomer as the connecting means between the pair of segments closest to the free end of the head and a hard elastomer as the connecting means between the pair of segments closest to the handle end of the head.

The elastomer is connected to the adjacent segments and/or to the handle so that the elastomer can be stretched to about 120%, preferably to about 150%, more preferably to about 200% of its unstressed length without separation of the elastomer from the head segments. This makes the present invention particularly suitable for constructing flexible head toothbrushes as will be described further herein. Preferably at least about 50%, more preferably at least about 75%, especially about

100% of the interfacial area between the elastomer and the head segment or handle, in any one elastomer / segment interface is connected to the segments to the extent described above.

By "without separation of the elastomer from the head segments" herein is meant that the elastomer does not become completely detached from the head segments. Since even partial loss of attachment of the elastomer to the head segment or handle can compromise the function and/or integrity of the implement, it is preferred that even partial detachment is avoided. In preferred embodiments, the elastomer will become detached over less than about 30%, preferably less than about 15%, more preferably less than about 5% of the connected interfacial area between elastomer and head segment or handle when the elastomer is stretched to at least about 120%, preferably to about 150%, more preferably to about 200% of its unstressed length. The above results should hold true whether the elastomer is stretched by linear deflection, bending or torsional movements of a segment relative to the adjacent segment or handle. Since, for some geometries of segment-segment or segment-handle connections, or for bending or torsional movements of one segment relative to its neighbour, there will be varying extents of elastomer stretching across an interface, care is required in measuring partial detachment. In such cases of differential elastomer extension, at each point on any one interface to be measured, the stretching should be measured along a line drawn through the elastomer which is perpendicular to the interface at the point where separation is to be determined, when the implement is in its rest, unstressed state. In bending or torsional modes it may be that this line will deviate from the perpendicular as one segment is moved relative to the other.

Over its lifetime, an implement having a resiliently flexible head, as described herein, may be subjected to stretching of the elastomer by e.g. bending of the head, many thousands of times. Preferably then, the elastomer-segment bond is able to withstand repeated extension and relaxation of the elastomer, to the extent described above, and back to the rest state through at least 10,000, preferably at least 25,000, more preferably 75,000 extension-relaxation cycles.

In highly preferred embodiments herein the head comprises at least one longitudinal groove which connects transversely disposed bands of elastomer and permits the elastomer to flow from one band to the other during an injection moulding process. In an implement with a co-moulded handle, this longitudinal groove can extend along the handle so that the same elastomer injection point in the mould that is

customarily used for supplying elastomer to form handle grips can also be used to inject the elastomer for the segment connecting means of the head. Normally the groove will not extend through the full depth of the handle or head at all points, though it can do so where desired, for instance to provide opposed grip points on top and bottom surfaces of the handle.

The present invention is particularly suitable for the manufacture of implements having a resiliently flexible head. By "resiliently flexible" is meant herein that when a 3 Newton force is applied to one end of the head, the other end being held fixed, the end to which the force is applied will deflect through an angle of at least 2° and, when the 3 Newton force is removed, the head will return to its original position without the application of external force. The end of the head which is to be held fixed is defined by the line which is perpendicular to the axis along which bending takes place and which touches the first point to comprise a grooming means, such as a row of toothbrush bristles. The end of the head where the force is to be applied is the opposite end of the head at the furthest point away along the bending axis. The angle through which the head bends when a 3 Newton force is applied as above is referred to herein as the flex angle. The flex angle can conveniently be measured by measuring the vertical displacement (y) of the free end of the head under a 3 Newton force and the distance y and the distance between the clamping point and the application of the force (x), the flex angle being derived by the relationship $\tan(\text{flex angle}) = y/x$. In preferred embodiments the flex angle is at least 3°, more preferably at least 5° and it can be as high as 15° or more.

In preferred embodiments herein, the implement comprises a grooming means on only one face of the head and that face is concavely shaped. In these embodiments the head preferably has a flex angle such that the concave face is able to bend to the extent that the face can become convex. In its rest state, the face of the head comprising the grooming means can be concave along either its longitudinal or transverse axis. Where the face is concave along the longitudinal axis, the radius of curvature may vary along the length of the head. The radius of curvature is preferably from 10 to 500 mm, more preferably from 15 to 250 mm, especially from 25 to 150 mm.

In use, toothbrushes according to this invention can be used for cleaning the teeth by an entirely conventional tooth brushing hand action, preferably in a manner recommended by dental health authorities. The implement can also be an electrically driven toothbrush.

The invention will now be described by way of example only, with reference to the accompanying drawings in which:

Fig. 1 is a perspective view of a toothbrush according to the invention. Some of the bristles are omitted for the sake of clarity.

Fig. 2 is a partial side view of the head of a toothbrush according to the invention.

Fig. 3 is a plan view of the bottom face of the head of a brush according to the invention.

Fig. 4 is a schematic showing the measurement of the flex angle.

Referring to Fig. 1, a toothbrush 1 has a resiliently flexible, flattened head 2, having a top face 3 and bottom face 4 which are substantially parallel to each other, and an elongated polypropylene handle 5. The head comprises four polypropylene segments 6, the first of which is continuous with handle 5. The segments are connected only by bands of a SEBS elastomer 7 having a hardness of 60 Shore A. The segments 6 are longitudinally sequenced along a longitudinal axis A-A. The bands of elastomer 7 extend across the transverse axis of the head B-B and from the top face 3 to the bottom face 4. Tufts of bristles 8 extend from top face 3. In practice, the brush has bristles extending from each of the four segments. Top face 3 is slightly concave, along the longitudinal axis A-A, having a radius of curvature of about 75 mm. The bands of elastomer afford sufficient flexibility to the brush head that it can bend along the longitudinal axis until the top face becomes convex. In doing so the elastomer is stretched along the top face. The elastomer on this face can stretch to more than 200% of its unstressed length without any observable loss of attachment of the elastomer to the segments. The head is able to repeatedly flex to this extent and back to the rest state through 75,000 cycles, without any detachment of the elastomer from the head segments. The handle comprises further regions 9 of the same elastomer to form a functional and attractive grip. The toothbrush is made by sequential injection moulding of first the polypropylene to form the handle 5 and segments 6 and then in a second step the elastomer is injected at a temperature of 255°C, thereby becoming fused to the polypropylene. After the brush has cooled the bristle tufts are inserted by the stapling technique into pre-formed tuft holes.

Referring to Fig. 2, a toothbrush head 2 having a free end 10 and handle end 11 is formed integrally at one end of a handle 5. The head includes five segments 6 which are longitudinally sequenced along the head. The segments are flexibly connected

by bands of elastomer 7 and the segment nearest the handle end 11 is flexibly connected to the handle 5 only by a band of elastomer. The bands of elastomer 7 extend completely across the transverse axis of the head and taper from the top to the bottom face. Along the top face the bands of elastomer have a width of about 1.2 mm and along the bottom face the bands of elastomer have a width of about 0.8 mm. Tufts of bristles 8 extend from the top face of the head. The toothbrush is made by sequential injection moulding and subsequent tufting as described above.

Referring to Fig. 3, a toothbrush head 2 is formed integrally at one end of a handle 5. The head includes four segments 6, one of which is continuous with handle 5. The segments are connected only by bands of a SEBS elastomer 7 having a hardness of 60 Shore A and which have a wave profile across the transverse axis of the head. A longitudinal groove 12 extends along the bottom face of the head and the handle, connecting the bands of elastomer so that they can all be formed from a single elastomer injection point. The top face, not visible in the figure, comprises a grooming means.

Fig. 4 illustrates the measurement of the flex angle. The head 2 is clamped 13 against the first row of bristles 14 at the end which is attached to the handle 5 and a 3 Newton force (F) is applied to the opposite end. The dashed lines show the original position of the brush head before the force is applied. The vertical displacement (y) of the free end of the head under the force F is measured and the flex angle is derived from the distance y and the distance between the clamping point and the application of the force (x) by the relationship $tan(flex\ angle) = y/x$.

WHAT IS CLAIMED IS:

1. A personal grooming implement, the implement comprising: a handle having two ends, and at one end of the handle a head comprising two or more segments, at least one of the segments comprising a grooming means, the segments being made from material having a modulus of elasticity of at least 500 MPa, the head being characterised in that at least one of the segments is joined to an adjacent segment or to the handle by a connecting means consisting essentially of an elastomer having a modulus of elasticity of less than 500 MPa, the elastomer being connected to the adjacent segments and/or to the handle so that the elastomer can be stretched to about 120% of its unstressed length without separation of the elastomer from the head segments.

2. An implement according to Claim 1 wherein the segments are disposed in longitudinal sequence along the head.

3. An implement according to Claim 2 wherein the head has a handle end and a free end and the head comprises a first head segment which is connected to or continuous with the handle and one or more additional head segments arranged in longitudinal sequence towards the free end of the head.

4. An implement according to any of Claims 1 to 3 wherein the implement is a toothbrush, the grooming means comprising a plurality of bristles extending from the segments of the head.

5. An implement according to any preceding claim wherein the head has a top face and a bottom face and the connecting means extends transversely across the head and from the top face to the bottom face.

6. An implement according to any preceding claim wherein the elastomer can be stretched to 150%, preferably 200% of its unstressed length without separation of the elastomer from the head segments.

7. An implement according to Claim 5 wherein the bands of elastomer have a thickness, measured along the longitudinal axis, in the range from about 0.1 mm to about 10 mm, preferably from about 0.3 mm to about 5 mm, more preferably from about 0.5 mm to about 3 mm.

8. An implement according to any preceding claim wherein the head comprises two, three or four segments.

9. An implement according to any preceding claim wherein the connecting means consists only of an elastomer.

Fig.1

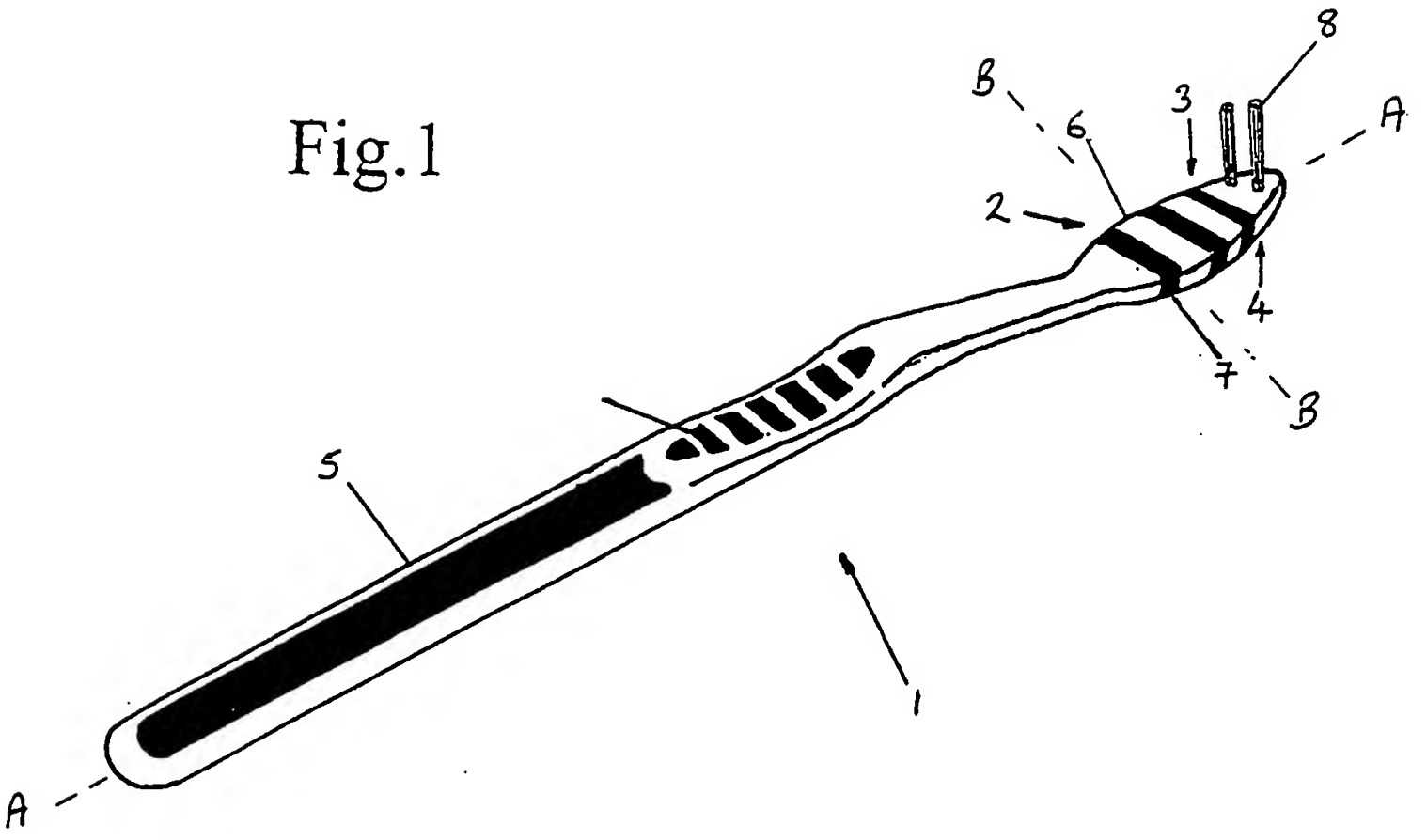


Fig. 2

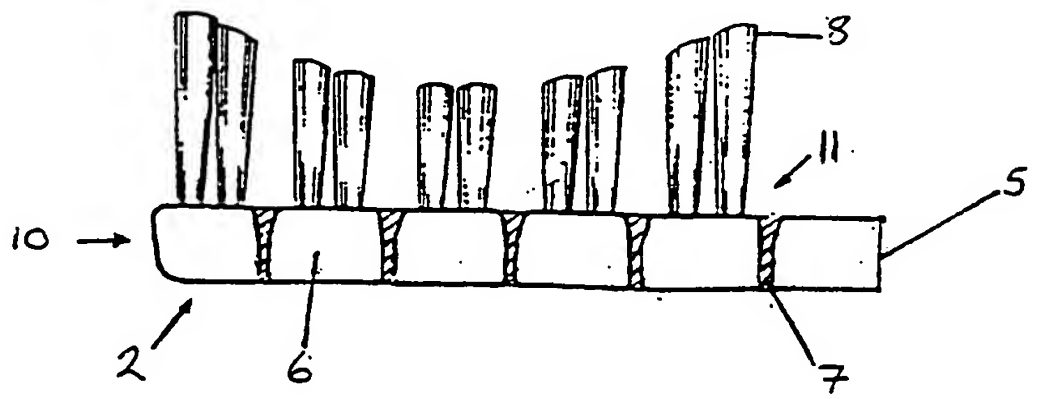


Fig. 3

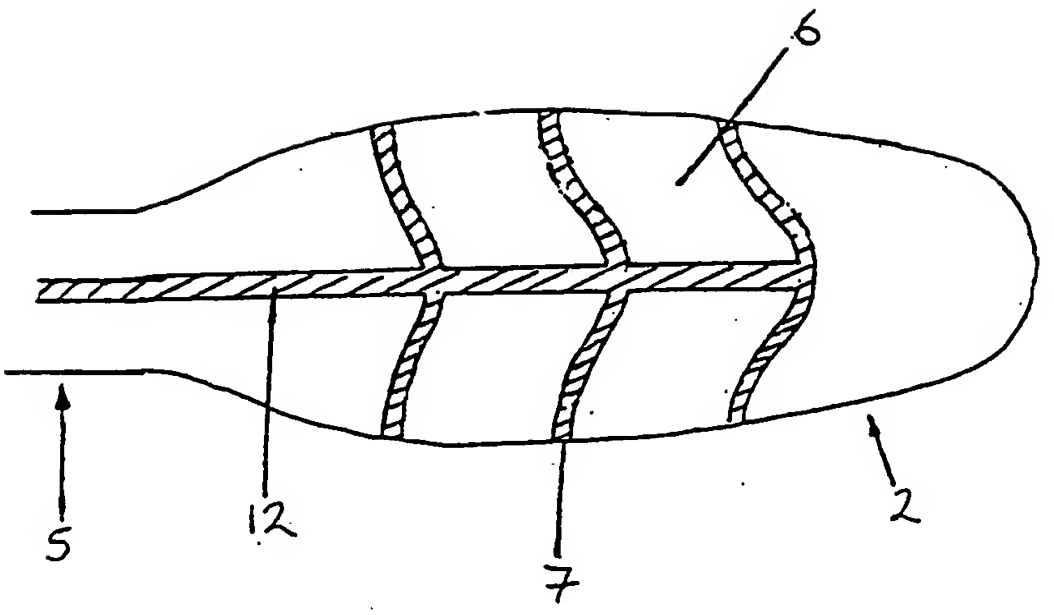
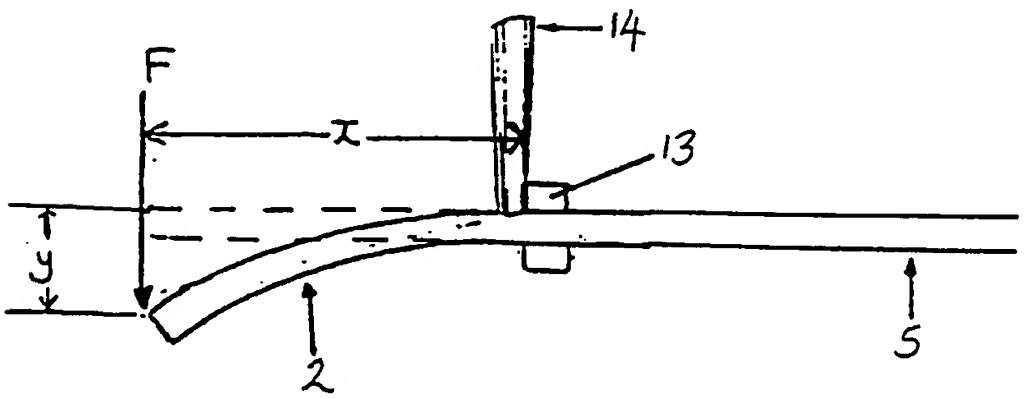


Fig. 4



INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A46B 9/04, 7/06
US CL : 15/167.1, 172, 201
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 15/167.1, 172, 201, 167.2

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 92/17093 A (HALM) 15 October 1992, page 5, lines 19-34	1-4
A	US 4,488,328 A (HYMAN) 18 December 1984	1-4
A	US, 2,676,350 A (BRESSLER) 27 April 1954	1-4
A	US 2,254,365 A (GRIFFITH ET AL) 02 September 1942	1-4

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 06 APRIL 1998	Date of mailing of the international search report 29 APR 1998
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer GARY K. GRAHAM Telephone No. (703) 308-0651

Form PCT/ISA/210 (second sheet)(July 1992)★

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/22682

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☒ Claims Nos.: 5-9
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.